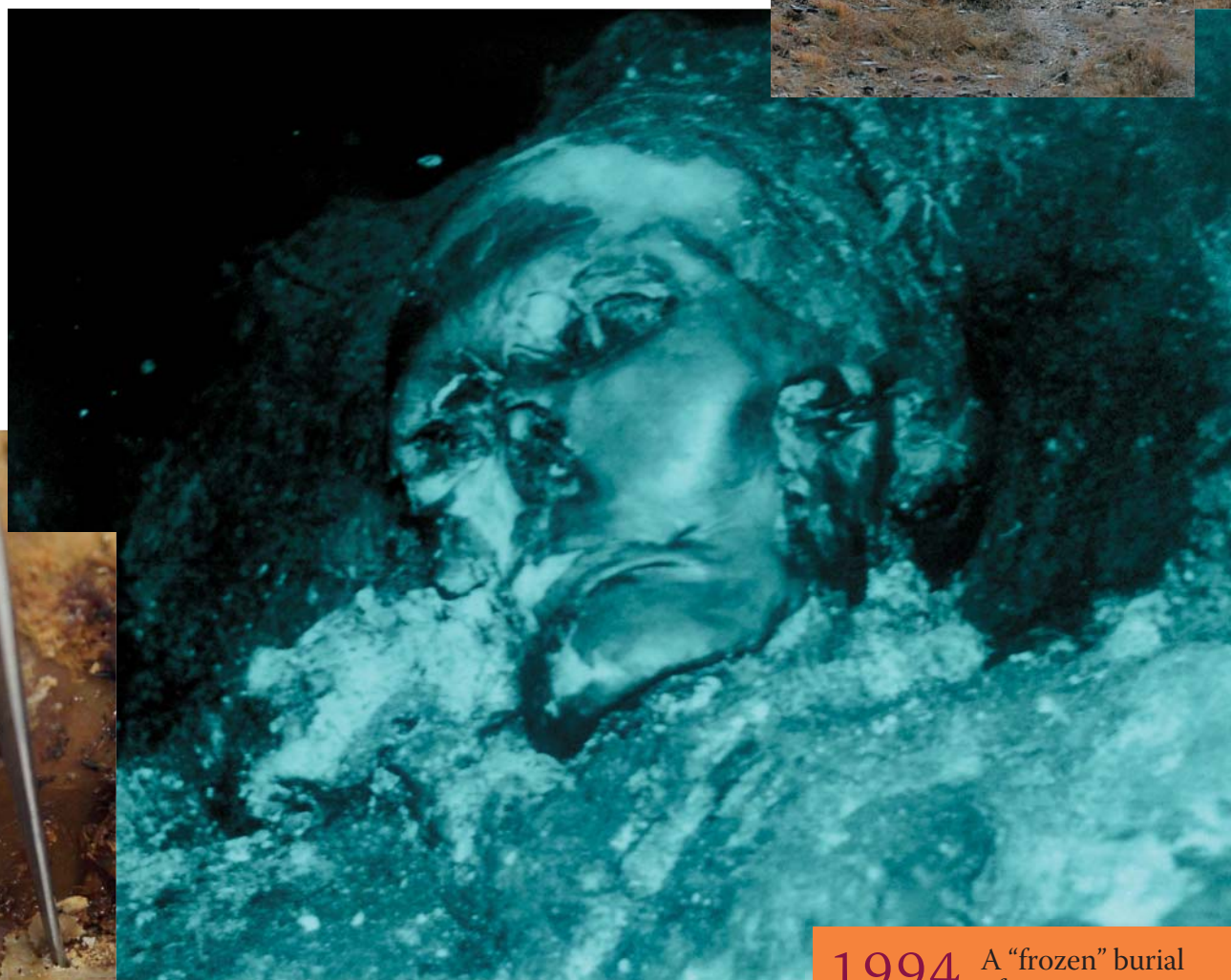




1994 A “frozen” burial of a woman was discovered on the Ukok Plateau

The Pazyryk Patient

A “frozen” burial on the Ukok Plateau stands as evidence of the skill of ancient surgeons

It happens sometimes that ancient burials that required much time and effort to excavate do not become the subject of further research or merit separate publication. One such forgotten site is the “frozen” burial of a woman discovered in mound 2 at Verkh-Kaldzhin 2, a Pazyryk burial ground on the Ukok Plateau in the Altai Mountains. Although the wooden frame was encapsulated in a lens of ice capable of preserving objects made of organic materials, not a single item was found within it. As the burial did not fit into the Pazyryk culture framework, it went “unclaimed.” But today the atypical nature of the burial is what arouses interest among researchers; moreover, a computed tomography scan of the buried woman’s skull revealed traces of a brilliantly performed maxillofacial surgery – evidence of the astonishing skill of ancient surgeons

On the left is a woman’s skull frozen into ice, with partially preserved facial skin, in situ. Verkh-Kaldzhin 2 burial ground. Photo by A. I. Solovyev from V. I. Molodin’s report, 1995

Key words: Pazyryk culture, Ukok plateau, Altai Republic, “frozen” burial, mound No. 2 of the Verkh-Kaldzhin II burial ground, X-ray computed tomography, temporomandibular joint injury, maxillofacial surgery



Natalia V. POLOSMAK, Corresponding Member of the Russian Academy of Sciences, Dr. Sci. (History); Chief Researcher, Paleometal Department, Institute of Archaeology and Ethnography SB RAS (Novosibirsk). Winner of the State Prize of the Russian Federation (2004), National Heritage Award (2006), and the Second Shanghai Archaeological Forum in the category “Archaeological Discoveries” (2015). Author and coauthor of over 400 research papers



Andrey Yu. LETYAGIN, Dr. Sci. (Medicine), Professor; Deputy Head for Research and Clinical Work at the Research Institute of Clinical and Experimental Lymphology, a branch of the Institute of Cytology and Genetics SB RAS; Deputy Director for Research at the Institute of Cytology and Genetics SB RAS (Novosibirsk). Author and coauthor of over 330 research papers and 10 patents

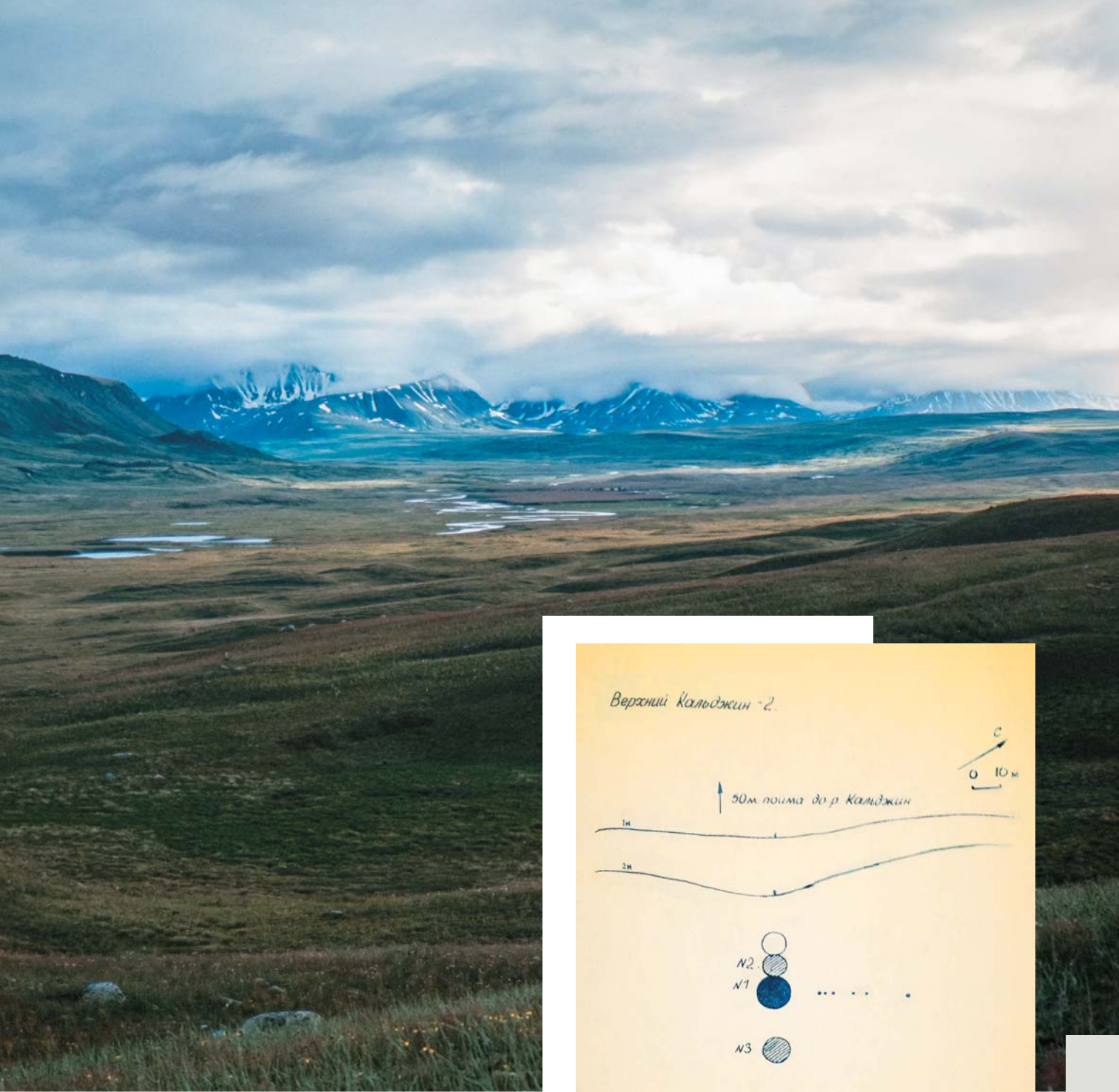


Vladimir V. KANYGIN, Cand. Sci. (Medicine), Associate Professor; Head of the Laboratory for Nuclear and Innovative Medicine, Department of Physics, Novosibirsk State University. Author and coauthor of over 100 research papers, including 1 monograph

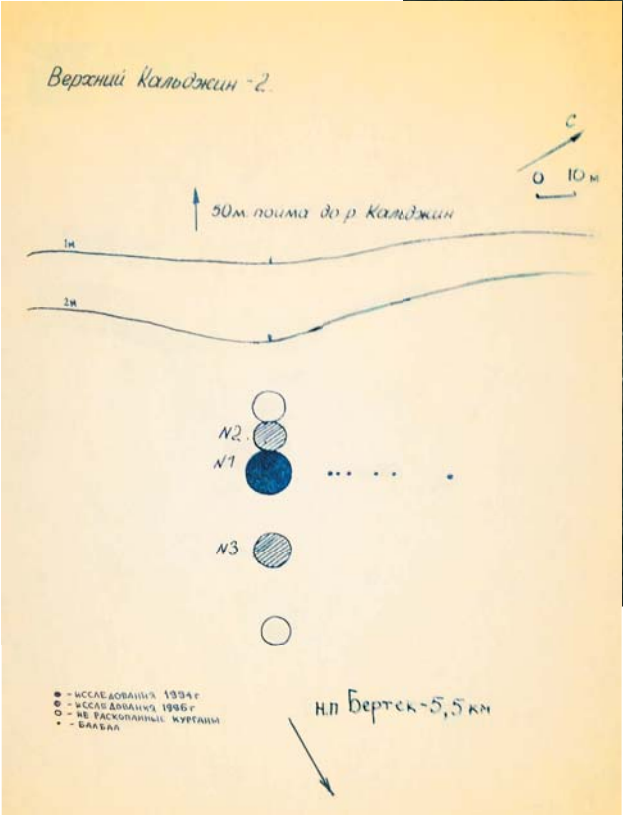
The Verkh-Kaldzhin 2 burial ground, attributed to the Pazyryk culture, was discovered by Vyacheslav I. Molodin back in 1994. The site is located on the right bank of the Kaldzhin River, a left tributary of the Ak-Alakha River. It consists of five burial mounds, extending in a chain perpendicular to the river along a northwest–southeast axis. In 1994–1995, Molodin studied three of the mounds and published material on two of them (mounds 1 and 3). Mound 3 became widely known for a remarkable find, i.e., a perfectly preserved male mummy, and numerous organic artifacts (Molodin, 2000). The year 2025 marked the 30th anniversary of this discovery. The very same chain also contains mound 2, which stands adjacent to mound 1; at the time of discovery, mound 2 attracted little attention (Molodin, 1996). Unlike the other Pazyryk burials of Ukok, this mound still remains largely unknown. With the permission of the excavator, we studied it in detail, using the data of his field report.

Unusual Pazyryk

The woman’s burial in mound 2 is strikingly unusual. Firstly, the above-ground burial structure itself has a notable design, not typical of the Pazyryk people. It is a ring 12 m in diameter and 1.7–2.8 m wide, made of boulders. The grave, accessed through a passageway on the western side, is located at the center of the structure. Its central part is not filled with stones – so far we have encountered such a structure in Pazyryk mound chains of the Greater Altai only once, i.e., in Barburgazy I mound 9 (Kubarev, 1992). Most likely, the above-ground structure we see today is the initial stage of construction of a typical small Pazyryk mound. Initially, a stone ring was laid around the grave, and the central part was filled with stones only after completing the burial rite. For some unknown reason, this burial structure remained unfinished. At the center of the 3.9 x 3.0 m burial pit, oriented northwest–southeast, stood a larch burial frame. Its first upper cover (3.2 x 3.5 m), originally located at the level



of the ancient daylight surface, consisted of 13 larch slabs, which had sunk and survived to this day in poor condition. The frame itself, according to the excavator, was remarkably well preserved. It is currently on display at the Anokhin National Museum of the Altai Republic (Gorno-Altaiisk). The two-crown wooden frame was made of *half-logs* (logs split lengthwise, with a flat interior and a convex exterior); the crowns were assembled by inserting rectangular tenons of the transverse logs into the grooves in the longitudinal



Layout of the Verkh-Kaldzhin 2 burial ground. From V.I. Molodin’s report, 1995

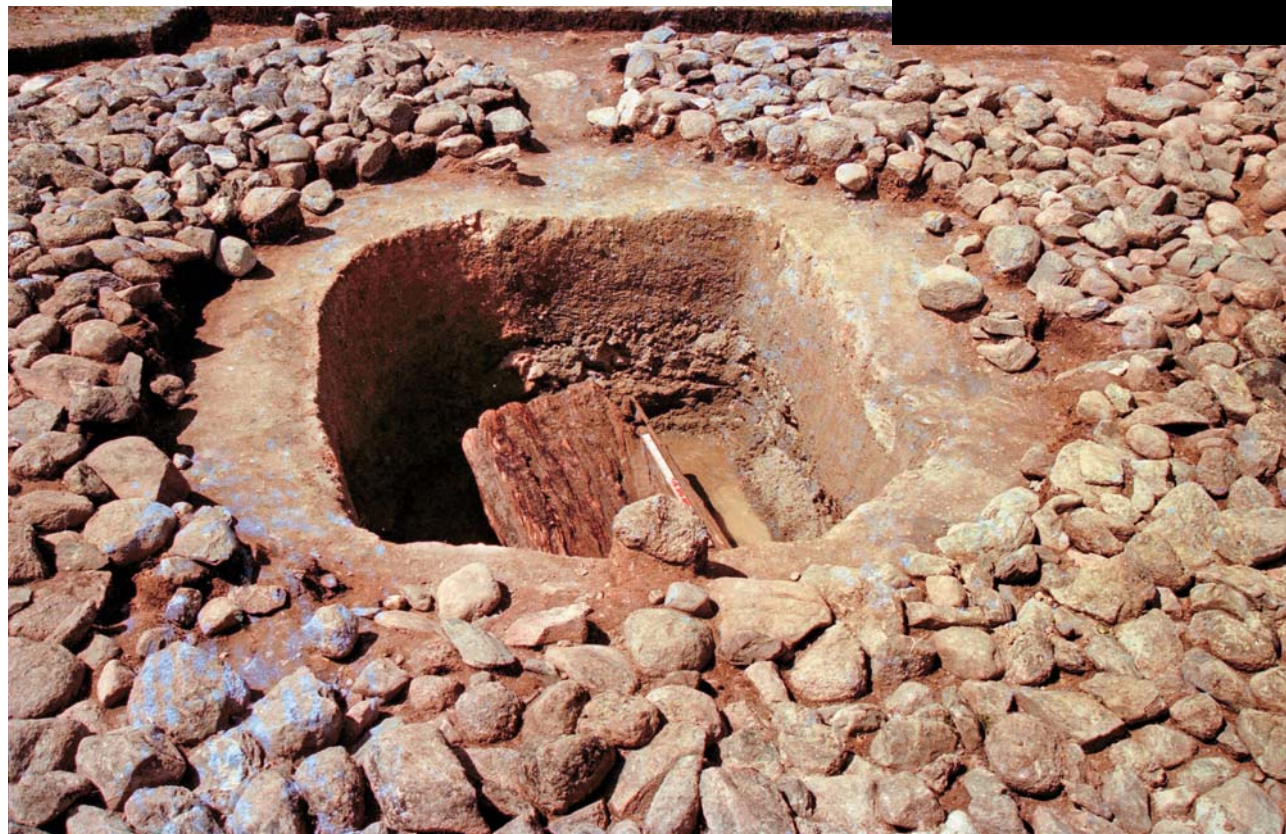


ones (Mylnikov, 2000). This wooden structure also sets this burial apart from the typical Pazyryk mounds with their dovetailed log frames.

The burial chamber was full of ice. When it melted, excavators discovered a burial bed in the southern part of the chamber. The bed consisted of two smoothly planed, tightly fitted planks with rounded ends. The planks were inserted into specially cut grooves located between the first and second crowns of the log frame.

As noted in the field report, a poorly preserved human corpse was lying on the burial bed, with the head of the deceased facing east–northeast. Some skin remained on the body, but the soft tissues were severely damaged. Nevertheless, it was clear that the deceased was a woman. She was lying in a sleeping position (common for Pazyryk burials): on her right side, with her legs bent at a right angle and her arms bent at the elbows, resting on her chest.

Unlike a typical Pazyryk mound, the central part of the burial structure of mound 2 was not filled with stones, leaving the burial unprotected. It was only the burial frame and bed, all made of larch, a wood resistant to external influences, that remained well preserved. Verkh-Kaldzhin 2 burial ground. Photo by A. I. Solovyev from V. I. Molodin's report, 1995



The Pazyryk culture is the only ancient culture on the territory of Russia, whose burials were found to contain well-preserved mummified bodies. The first such burials were discovered in the mid-20th century during excavations in the east of the Altai Mountains. In 1993, archaeologists found for the first time a “frozen” burial not touched by looters. This mound, found within the Ak-Alakha 3 burial ground on the Ukok Plateau, revealed a mummy of a young woman and a remarkable collection of items that accompanied her into the afterlife. The Pazyryk mummies were created using certain manipulations on the bodies of the deceased. This fact compels us to believe that the Pazyryk culture was a complex cultural and historical phenomenon that remains to be understood

The woman wore a voluminous wig. There was an approximately 30 cm long void between her head and the eastern wall of the burial chamber. It can be confidently assumed that this space originally contained a high wig crown, replicating the design of the well-known headdress of the woman buried at Ak-Alakha 3 mound 1. According to dendrochronological analysis, both of these women were buried in 413 BCE (Slyusarenko, 2000, p. 263).

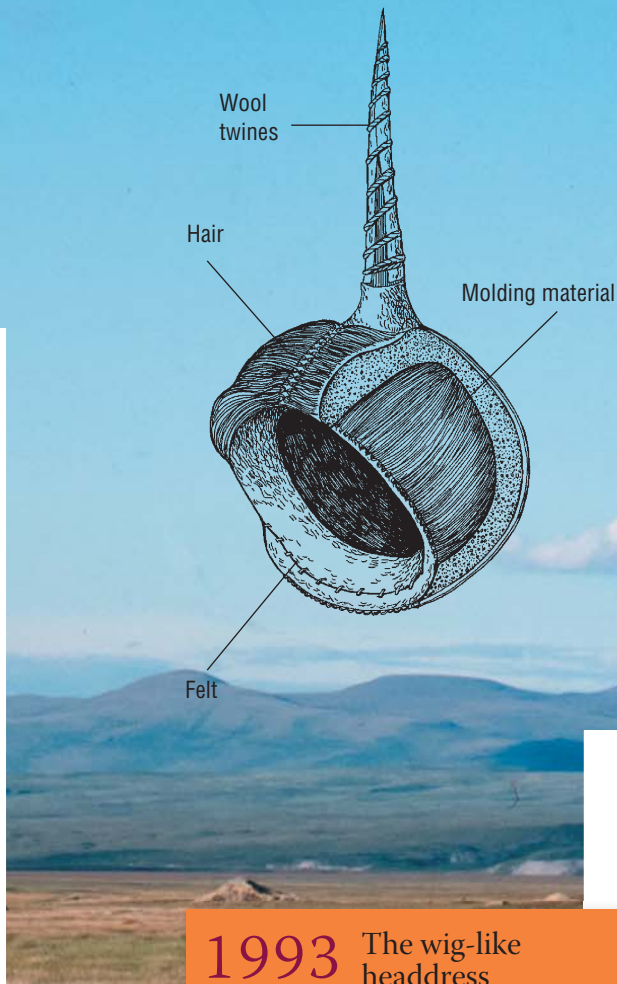
A study of the woman's wig from Verkh-Kaldzhin, conducted by E. V. Karpova, Cand. Sci. (Chem.) Novosibirsk Institute of Organic Chemistry SB RAS), revealed that the black filling used to create the hairstyle consists of animal fat mixed with carbonized plant material and is similar in composition to the wig from Ak-Alakha 3. The hair used to make the wig likely belonged to the deceased herself. The study also revealed small fragments of very thin leather, which could have been remnants of the wig's inner core.

Another strange feature of this burial is the complete absence of material objects. This is largely the reason why this site escaped the attention of researchers. The report mentions only small fragments of woolen fabric (possibly a skirt); some particles of black felt; and six wooden nails in the walls of the log frame, which may have held the felt in place.



Remains of the woman from mound 2. She was buried wearing a wig-like headdress typical of the Pazyryk culture. Verkh-Kaldzhin 2 burial ground. Photo by A.I. Solov'yev from V.I. Molodin's report, 1995

1994 The wig-like headdress on the head of the woman from the burial discovered in 1994



1993 The wig-like headdress of the woman discovered on the Ukok Plateau in 1993



Pazyryk women's wig-like headdress: general view and design diagram. Ak-Alakha 3 mound 1. Reconstruction by E. Shumakova; drawing by D. Pozdnyakov. Museum of the Institute of Archaeology and Ethnography SB RAS

“...The greater part of me will never die, however much decaying faculties condemn”*

Judging by the circumstances of the burial, the wig found on the woman should have been decorated with carved cedar figurines of animals and birds, as was common in the Pazyryk culture. Why did they not survive – and neither did her attire – if the burial chamber itself, as well as the wooden bed, were in excellent condition?

It can be assumed that this odd absence is due to the burial not having been sheltered with stonework. Thus, for over two thousand years it was covered at the daylight surface level only by a roof of wooden slabs. Over time, this roof sank, collapsed, and became overgrown by a layer of sod. In fact, the burial inside the log frame had been lying unprotected for centuries. By the time it was filled

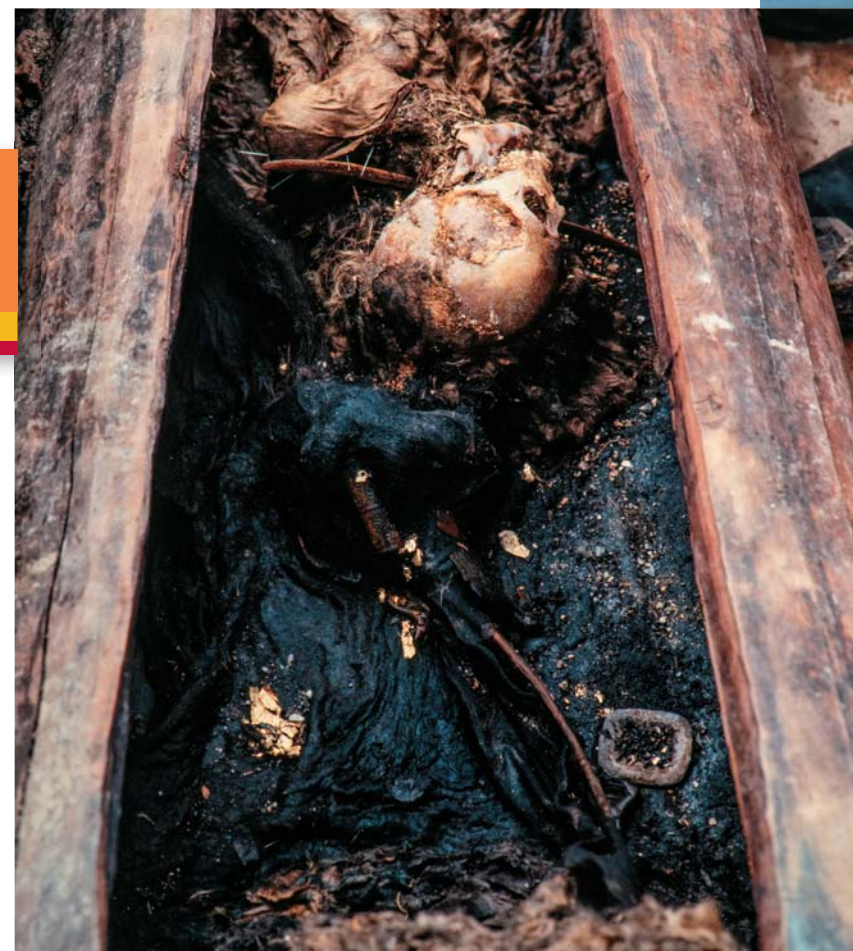
with water and finally encased in ice, most of the organic objects had already decayed, as is typical of Pazyryk graves under normal conditions. However, both the log frame and the burial bed were made of larch, a wood known to harden like stone when exposed to water for long periods. The same cannot be said of the finely carved wig ornaments made of cedar wood, which is porous and quickly absorbs moisture.

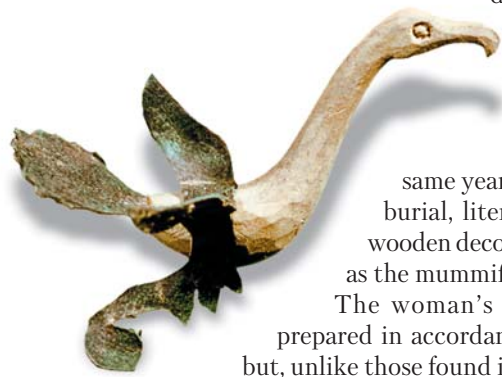
However, this circumstance does not explain the complete absence of metal objects, e.g., a bronze mirror, or such objects as a horn comb or vessel, beads, ceramics, and even ram bones, the traditional food offered to the dead. The burial's greatest oddity lies in the absence of these objects rather than in the loss of those that easily perish.

This burial demonstrates the crucial role played by stone covering in preserving organic objects in Pazyryk burials, as pointed out by Sergei I. Rudenko, one of the

The log containing the mummified body of a woman buried in Ak-Alakha 3 mound 1. This frozen burial preserved a variety of organic objects, including a wig-like headdress, which occupied one-quarter of the interior of the larch log. Photo by M. Seifert

* From the poem Monument (1795) by Gavriil Derzhavin. Translated by C.J. Holcombe





discoverers of the Pazyryk culture. Let us take as an example the abovementioned male burial in mound 3, where, according to dendrochronological analysis, the man was buried in the same year as the woman in question. In this burial, literally everything survived: carved wooden decorations, clothing, felt items, as well as the mummified body itself.

The woman's body from mound 2 had been prepared in accordance with the Pazyryk burial rites, but, unlike those found in the Ukok graves, it did not turn into a mummy. The mummification process required sufficient time to pass between death and burial. She likely died in the spring, when her tribesmen were migrating from their winter pastures, and was therefore buried without delay. During the summer and fall, the contents of the poorly protected grave suffered from sudden temperature fluctuations and deteriorated. Only by winter, filled with rainwater, could it freeze and never thaw. However, by this time, any organic objects that might have been there had disappeared. It was only the partially intact body that remained, along with a few small fragments of a skirt and felt particles.

Yet the ice that formed in the burial chamber of mound 2 preserved the partially mummified woman's skull, which was embalmed at the All-Union Research Institute of Medicinal and Aromatic Plants (Moscow). The skull is currently kept at the Institute of Archaeology and Ethnography SB RAS (Novosibirsk). It was a computed tomography (CT) scan of this skull that revealed an ultimately fascinating piece of evidence, which helped shed light on the fate of this Pazyryk woman.

What did the CT scanner "see"?

Using X-ray CT scanning, researchers made and 3D-printed a model of the skull, having removed the mummified skin covering almost half of the face. This model allowed a study by physical anthropology methods, which could not be applied to the skull itself.

It turned out that the *neurocranium* (i.e., the braincase or brain box) contained, judging by the volume of the contents, some residual fragments of neural tissue of the *cerebellum*, *right parietal lobe*, and *occipital lobe*. The remainder of the brain had been intentionally removed because the cranial cavity contained no remnants of the *dura mater*, which should have been present there given the state of preservation of the neural tissue. Professor Andrey Yu. Letyagin hypothesized that the removal of the most part of the brain along with the *dura mater* was performed after partial decapitation through the foramen magnum using a fairly long, straight instrument (such as a knife or stiletto).

Amazing information was obtained while studying the facial bone structures. It turned out that the right temporomandibular joint exhibited a clear subluxation with *lateral displacement*, causing the head of the lower jaw to move sidewise, and a severe damage to the *lateral ligament*, which inhibits lateral movement of the jaw.

The injuries were caused by a traumatic deformation of the neurocranium with an approximately 6–8-mm depression of the bones of the right temporal area. The lower jawbone remained intact, but the right temporomandibular joint disintegrated, and the right head of the lower jaw was displaced underneath the



The elaborate wig-like headdress worn by the woman from Ak-Alakha 3 mound 1 was decorated with animal and bird images carved from cedar. All the pieces were covered with gold foil.
Drawing by D. Pozdnyakov

Postmortem decapitation has been repeatedly documented among the Pazyryk people. For example, a procedure involving the removal of the skull and some of the cervical vertebrae was performed on the body of a woman buried at Ak-Alakha 3 mound 1 (Hauri and Blatter, 2000). The Pazyryk people regarded this procedure, along with the removal of internal organs, as one of the most important manipulations in preparing the bodies of the deceased for burial

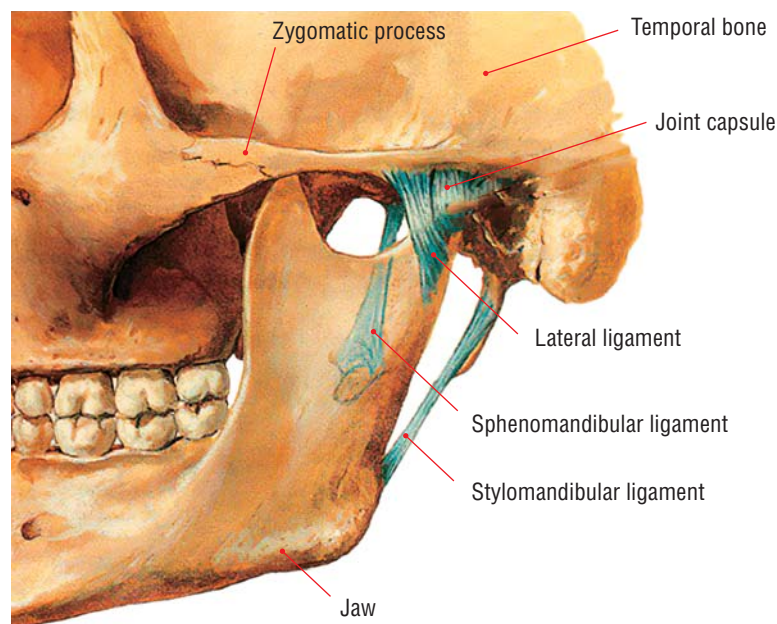


According to X-ray CT data, the cranial cavity of the woman from Verkh-Kaldzhin 2 mound 2 contains only some fragments of brain tissue

An X-ray CT scanning of the skull from Verkh-Kaldzhin 2 mound 2 was performed at Novosibirsk State University using a Philips MX 16 CT scanner. Using 551 slices (0.75 mm thick; 0.375 mm distance between the slices; 140 kVp, typical for adult patients), researchers visualized the bone skeleton of the neuro- and viscerocranium together with residual soft tissue elements on the left side of the viscerocranium, in the left temporal fossa, in both orbits, and on the forehead. The study was conducted by Vladimir V. Kanygin



3D model of the neuro- and viscerocranium of the woman from Verkh-Kaldzhin 2 mound 2. Left side view. Tissue density staining



The temporomandibular joint, which connects the temporal bone to the lower jaw, consists of two anatomically separate joints (right and left). Its main function is to ensure jaw movements necessary for speaking, chewing, and swallowing. The joint's lateral ligament is the strongest one. It stabilizes the joint from the outside, bearing the brunt of the load during chewing and yawning, and also prevents excessive forward protrusion of the jaw.

skin. All this was accompanied by a rupture of the lateral portion of the joint capsule and damage to the intracapsular ligaments as well as a rupture of the extracapsular lateral ligament. Such a severe injury leads to articulation and chewing disorders as well as voice disorders caused by the asymmetry of the temporomandibular joints.

A through-drilled hole up to 1.53 mm in diameter and up to 7.45 mm in length was discovered in the right head of the lower jaw, directly beneath the articular surface. Another hole up to 1.53 mm in diameter and up to 5.60 mm in length was found in the right temporal bone; the hole leads from the outer edge of the glenoid cavity of the temporomandibular joint upward into the temporal fossa. The canals meet at a single point, resembling the letter "L" with an angle of 110° when the mouth was closed. When the mouth was open, the angle could have decreased to 80–90°.

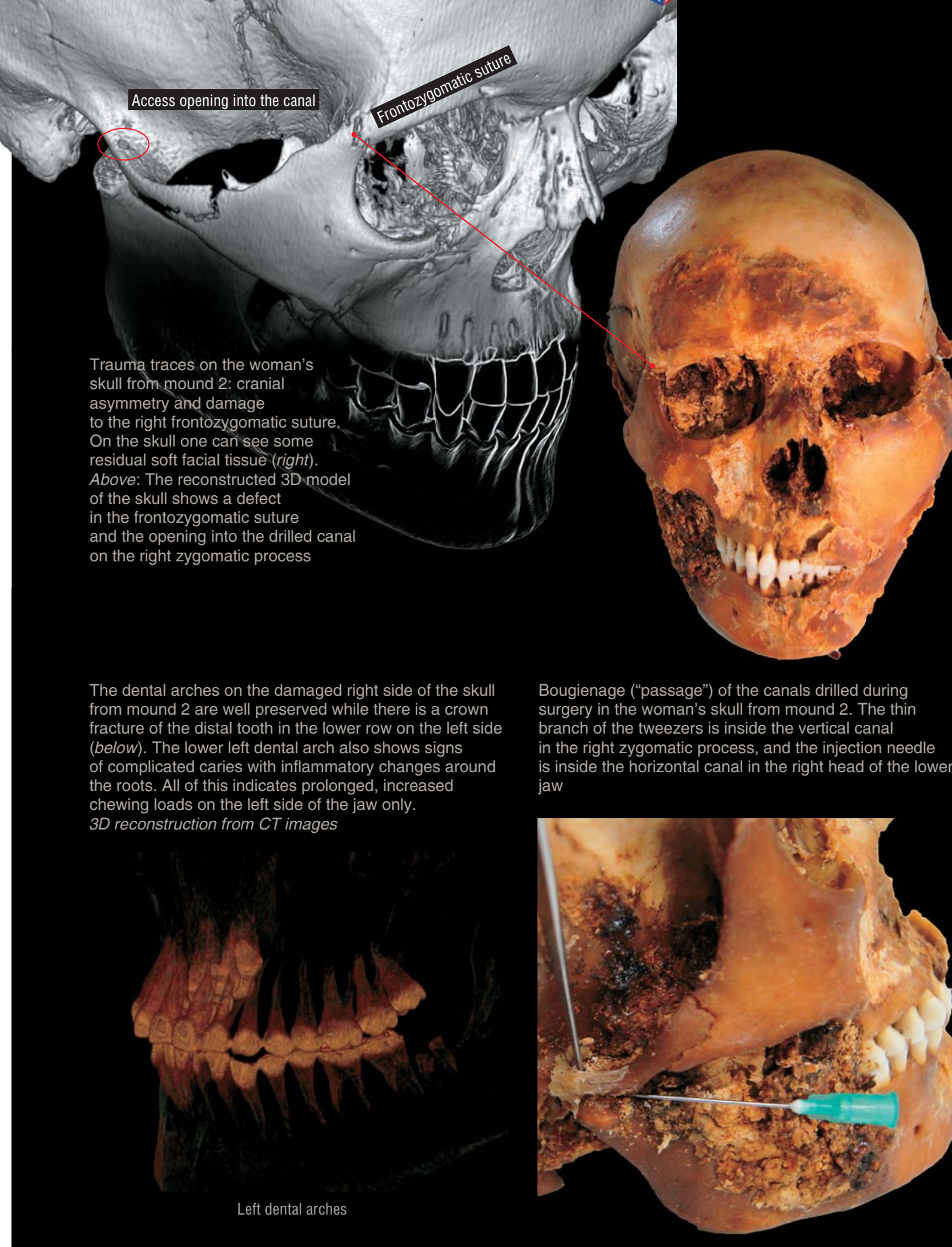
An annular bone compaction (up to 0.5–0.6 mm thick) indicates that the canals were drilled intravitaly and stand as evidence of a surgery aimed to correct post-traumatic joint dysfunction. The drilling was performed with the mouth open in two stages: horizontally and vertically. The canals contained elastic material (most likely, an animal tendon or horsehair), which maintained contact between the articular surfaces and allowed for movement even during subluxation.

The CT scanning results made it possible to reconstruct some events in the life of a woman buried approximately 2500 years ago on the Ukok Plateau. She was 30–35 years old at the time of her death, and she had once suffered a severe traumatic skull deformation. The injuries suggest a fall from a height or from a galloping horse. Apparently, the blow came from the right side, causing the skull bones to be displaced and compressed inward. The lower jawbone itself was undamaged, but its right head was displaced from the glenoid fossa, tearing both the joint capsule and the extracapsular lateral ligament, making the woman unable to chew.

She subsequently underwent life-saving surgery to restore lower jaw function. Apparently, the ancient surgeon installed a primitive "ligature" in place of the torn ligament, allowing the woman to chew on her left side, where our research discovered dental defects. Annular bone densities around the drilled cranial canals and asymmetry in the dental arches indicate that she successfully underwent the surgery and lived afterwards for quite some time.

The ancient world knows many examples of successful surgical interventions. Even the ancient Egyptians performed complex surgeries such as limb amputations and craniotomy. Judging by the Code of Hammurabi, also quite capable were the physicians of ancient Mesopotamia. Ancient Indian surgeons practiced plastic surgery, and ancient Chinese bone-setters were capable of setting fractures and dislocations as well as fixing the repositioned bones.

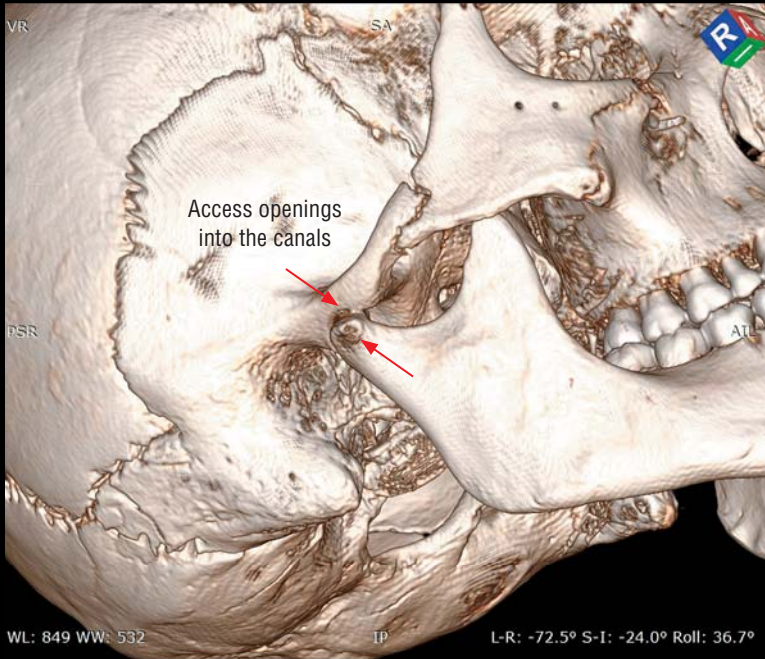
The Pazyryk people dissected their deceased tribesmen, removing their internal organs, brains, and fatty deposits to preserve the bodies until burial. This means they had a fairly good understanding of the internal structure of the human body and



Trauma traces on the woman's skull from mound 2: cranial asymmetry and damage to the right frontozygomatic suture. On the skull one can see some residual soft facial tissue (right). Above: The reconstructed 3D model of the skull shows a defect in the frontozygomatic suture and the opening into the drilled canal on the right zygomatic process.

The dental arches on the damaged right side of the skull from mound 2 are well preserved while there is a crown fracture of the distal tooth in the lower row on the left side (below). The lower left dental arch also shows signs of complicated caries with inflammatory changes around the roots. All of this indicates prolonged, increased chewing loads on the left side of the jaw only. 3D reconstruction from CT images.

Bougienage ("passage") of the canals drilled during surgery in the woman's skull from mound 2. The thin branch of the tweezers is inside the vertical canal in the right zygomatic process, and the injection needle is inside the horizontal canal in the right head of the lower jaw.

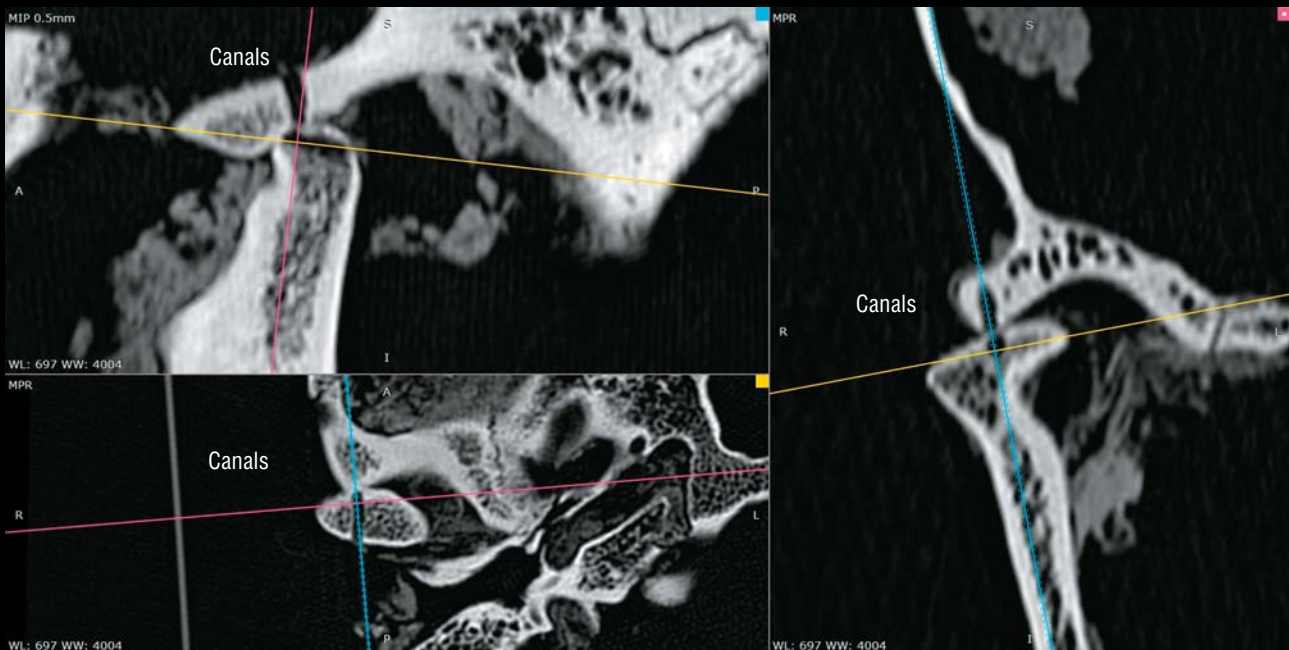


2025 Traces of surgery were found on the skull of the woman discovered in 1994 on the Ukok Plateau

The reconstructed 3D model of the skull shows access openings into canals drilled in the skull found in Verkh-Kaldzhin 2 mound 2

for successful intravital operations as well as posthumous craniotomy (Chikisheva and Krivoshapkin, 2015). Risky surgical interventions often saved or prolonged lives, demonstrating not only the growing skill of Pazyryk healers but also the value they attached to the life of every member of their society.

X-ray CT scans; colored lines run through the cavities of the drilled canals



Compelling evidence of this is also the results obtained by studying the woman's skull from Verkh-Kaldzhin 2 mound 2. Researchers now apply new methods to study ancient human remains and archaeologists pay attention not only to populations but also to individuals, which is why we have learned a lot about this forgotten woman and the culture in which she lived. These studies testify that as early as 2500 years ago, unknown ancient healers dared to undertake most unexpected and difficult surgical procedures to save the life of their fellow tribesmen.

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